

**REMARKS**

The applicants thank the Examiner for the thorough examination of the application. The specification has been amended to correct minor errors. No new matter is believed to be added to the application by this amendment.

**Status of the Claims**

Claims 1-21 are pending in the application. The Examiner has withdrawn claims 3-7, 9, 14-17 and 19 from consideration. The amendments to claims 8 and 18 find support in Figure 1 and at page 8, lines 9-12 of the specification. Claim 11 has been amended to clarify its language. Claim 20 finds support at page 11, line 7 to page 15, line 25 of the specification. Claim 21 finds support in Figure 1. The claims have also been amended to improve their format.

**Election/Restriction**

The Examiner has withdrawn claims 3-7, 9, 14-7 and 19 from consideration. However, these withdrawn claims all ultimately depend upon one of elected product claims 1 or 10 of Group I. As a result, a finding of allowability of claims 1 and 10 of Group I would render all the claims of Group I allowable.

The Examiner is accordingly respectfully requested to rejoin upon indication of allowable subject matter.

**Rejection Under 35 U.S.C. §102(b) Over Okumura**

Claims 1, 2 and 8 are rejected under 35 U.S.C. §102(b) as being anticipated by Okumura (U.S. Patent 6,370,176). Applicants respectfully traverse.

**The Present Invention and its Advantages**

The present invention pertains to an epitaxial substrate for a compound semiconductor light-emitting device that improves crystallinity in the vicinity of the pn junction, thereby facilitating hole injection, without degrading the light-emitting layer structure protection performance. The invention includes a p-type layer structure formed in contact with the light-emitting layer structure, where the p-type layer structure has a triple layer construction composed of an n-type first layer, a p-type second layer and a p-type third layer. The result is excellent performance even if the layer thickness is small.

The invention finds a typical embodiment in claim 1:

1. An epitaxial substrate for a compound semiconductor light-emitting device comprising:
  - a double-hetero light-emitting layer structure including a pn junction; and
  - a p-type layer side layer structure formed in contact with the light-emitting layer structure including in order from the layer in contact with the light-emitting layer structure an n-type first layer represented by  $\text{In}_x\text{Al}_y\text{Ga}_z\text{N}$  ( $x + y + z = 1$ ,  $0 \leq x \leq 1$ ,  $0 \leq y \leq 1$ ,  $0 \leq z \leq 1$ ), a p-type second layer represented by  $\text{In}_u\text{Al}_v\text{Ga}_w\text{N}$  ( $u + v + w = 1$ ,  $0 \leq u \leq 1$ ,  $0 \leq v \leq 1$ ,  $0 \leq w \leq 1$ ) and a p-type third layer represented by  $\text{In}_p\text{Al}_q\text{Ga}_r\text{N}$  ( $p + q + r = 1$ ,  $0 \leq p \leq 1$ ,  $0 \leq q \leq 1$ ,  $0 \leq r \leq 1$ ), each of the three neighbors being formed in contact with its neighbor.

Distinctions of the Invention Over Okumura

Figure 1 of Okumura depicts a semiconductor laser that includes a quantum well 7 over which is consecutively found an  $\text{Al}_{0.2}\text{Ga}_{0.8}\text{N}$  evaporation prevention layer 8, a p-type GaN guide layer 9 and a p-type  $\text{Al}_{0.1}\text{Ga}_{0.9}\text{N}$  cladding layer 10 (see Okumura at column 7, lines 45-60). This laser of Okumura may at first appear comparable to the  $\text{In}_x\text{Al}_y\text{Ga}_z\text{N}$  n-type first layer,  $\text{In}_u\text{Al}_v\text{Ga}_w\text{N}$  p-type second layer and  $\text{In}_p\text{Al}_q\text{Ga}_r\text{N}$  p-type third layer of claim 1 of the invention.

However, Okumura at column 7, lines 56-57 states that "the  $\text{Al}_{0.2}\text{Ga}_{0.8}\text{N}$  evaporation prevention layer 8 may be doped with Mg." As a result, the evaporation layer 8 of Okumura is a **p-type** layer that cannot be compared to the **n-type**  $\text{In}_x\text{Al}_y\text{Ga}_z\text{N}$  first layer of the invention.

Also, Okumura only teaches specific ratios for the first and third layers. That is, the  $\text{Al}_{0.2}\text{Ga}_{0.8}\text{N}$  evaporation prevention layer 8 of Okumura has a different formula ratio than AlGa<sub>N</sub> layer 9 shown in Figure 1. Similarly, the  $\text{Al}_{0.1}\text{Ga}_{0.9}\text{N}$  cladding layer 10 of Okumura is different from the GaN third layer 11 shown in Figure 1 (see also, claim 21).

As a result, Okumura fails to teach each and every element of claim 1. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete

detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Okumura therefore fails to anticipate claim 1. Claims dependent upon claim 1 are patentable for at least the above reasons. This rejection is overcome and withdrawal thereof is respectfully requested.

**Rejection Under 35 U.S.C. §102(b) Over Doverspike**

Claims 10-13 and 18 are rejected under 35 U.S.C. §102(b) as being anticipated by Doverspike (U.S. Patent 6,459,100). Applicants respectfully traverse.

Figure 1 of Doverspike shows a quantum well 12 over which is consecutively formed an undoped GaN layer 15, an undoped AlGaN layer 21 and a p-type AlGaN:Mg layer 22 (See Doverspike at column 5, lines 55-60). Doverspike fails to disclose that the undoped GaN layer 15 is n-type, and that the undoped AlGaN layer 21 is n-type.

However, the Examiner improperly turns to the applicants' own disclosure at page 9 for teachings that undoped layers are n-type. The rejection is thus improper for two reasons: 1) an anticipation rejection under 35 U.S.C. §102 is only valid if a single reference teaches each and every element of the rejected claim; and 2) using the applicants' own disclosure as prior art without an admission of prior art is improper.

In order for an anticipation rejection to stand, each and every element must be fairly disclosed in a prior art reference (*see Verdegaal, supra*). However, at page 3, lines 7-8, the Examiner states that “as is known in the art and stated in applicant’s disclosure at page 9, GaN layers grown at low temperature are invariably n-type.” However, the applicants have made no admission of prior art, and utilizing the applicants’ disclosure as prior art without an admission of prior art is improper (see, e.g., *Riverwood International Corp. v. R.A. Jones & Co., Inc.*, 324 F.3d 1346, 66 USPQ2d 1331 (CAFC 2003)).

Therefore, Doverspike fails to anticipate or suggest (if one assumes *arguendo* that the rejection was for obviousness under 35 U.S.C. §103) the invention of claim 10. Claims depending upon claim 10 are patentable for at least the above reasons. This rejection is overcome and withdrawal thereof is respectfully requested.

#### **Objection to Claims 8 and 18**

The Examiner objects to claims 8 and 18 as failing to further limit the subject matter of the previous claim. Claims 8 and 18 have been amended to recite “an electrode.” This limitation is not found in any of the previous claims. Claims 8 and 18, as amended, clearly limit the subject matter of the claims upon which they depend.

**Rejection Under 35 U.S.C §112, First Paragraph**

Claims 11 and 13 are rejected under 35 U.S.C §112, first paragraph as not being enabled. Applicants respectfully traverse.

At page 4, lines 3-5 of the Office Action, the Examiner asserts: "It is not seen how the second layer can possibly be n-type if the p-type dopant density is larger than the n-type dopant density. Clearly the 10E21 p dopant density and 10E19 n dopant density the layer will be p-type, contradictory to claim 10."

However, an "n-type second layer" means a second layer where the conductivity type is n-type. Therefore, the n-type second layer can have a p-type dopant and an n-type carrier (see claim 20). This technology is discussed at pages 11-15 of the specification, and this discussion needs no modification. Therefore, there is no contradiction to claim 10.

This rejection is overcome and withdrawal thereof is respectfully requested.

**Prior Art**

The prior art cited but not utilized by the Examiner indicates the status of the conventional art that the invention supercedes. Additional remarks are accordingly not necessary.

**Information Disclosure Statements**

The Examiner is thanked for considering the Information Disclosure Statement filed May 24, 2004 and for making the initialed PTO-1449 form of

record in the application in the Office Action mailed September 8, 2004. The Examiner is respectfully requested to consider the Information Disclosure Statement filed August 23, 2004 and to make the initialed PTO-1449 form of record in the application in the next official action.

### **The Drawings**

The Examiner has indicated that the drawing figures are acceptable in the Office Action mailed September 8, 2004.

### **Foreign Priority**

The Examiner has acknowledged foreign priority in the Office Action mailed September 8, 2004.

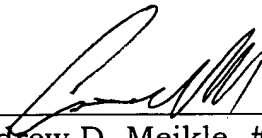
### **Conclusion**

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Robert E. Goozner, Ph.D. (Reg. No. 42,593) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By   
Andrew D. Meikle, #32,868

  
ADM/REG/jls

P.O. Box 747  
Falls Church, VA 22040-0747  
(703) 205-8000

Attachment(s):